REMARKS/ARGUMENTS

Claims 1, 3-26, and 18 are pending. Claims 1-18 stand rejected. Claims 2 and 17 are cancelled herein without prejudice. Claims 1, 16 and 18 are amended herein. No new matter has been added herein as a result of the amendments. Applicants respectfully request further examination and reconsideration in view of the instant response.

Claim Amendments

Claim 1 is amended to reflect the following (amended Claim 16 includes similar features):

> A method of compiling a program to be executed on a target microprocessor with multiple functional units of a same type, the method comprising opportunistically scheduling a redundant operation on one of the functional units that would otherwise be idle during a cycle and scheduling a comparison of results from the redundant operation.

Support for the above amendments can be found at least in Claims 2 and 17.

Claim 16 is amended to reflect the following (amended Claim 18 includes similar features):

> A ~~program~~ computer-readable medium embedded with a compiler program for executing on a target microprocessor, the computer-readable medium comprising: ~~with~~
> multiple equivalent functional units[[,]]; ~~the~~
> a compiler comprising:
> a code generator including a scheduler that opportunistically schedules a redundant operation on one of the functional units that would otherwise be idle during a cycle.

Support for the above amendments can be found at least in Figures 1 and 2, page 3, lines 24-34, and page 4, lines 1-17.

CLAIM REJECTIONS

35 U.S.C. §101 Rejections

The Office Action mailed on December 24, 2008 (hereinafter, "instant Office Action") rejects Claims 16 and 18 "because the claimed invention is directed to non-statutory subject matter" (instant Office Action, page 2, section 1). For example, the instant Office Action states:

> In claims 16, a "program compiler", "code generator" and "scheduler" are representative of the software. Therefore, claim [1]6 has been rejected because it is reasonably interpreted as functionally descriptive material, per se. Software, per se, is not one of the statutory subject matter.

(Instant Office Action, page 2, section 1.) Claim 18 is similarly rejected. Applicants respectfully submit that Claims 16 and 18 are amended herein to reflect statutory subject matter. Applicants also respectfully note that Claim 17 is cancelled without prejudice herein. Thus, Applicants respectfully submit that the 35 U.S.C. §101 rejection with respect to Claim 17 is moot. Additionally, Applicants respectfully submit that the 35 U.S.C. §101 rejections of Claims 16 and 18 are traversed.

35 U.S.C. §103(a) Claim Rejections

A. Claims 1-3, 5-10, 14-15, and 18

Claims 1-3, 5-10, 14-15, and 18 are rejected under 35 U.S.C. §103(a) as being unpatentable over Metzger (U.S. Patent Application No. 7,269,827) in view of Tirumalai et al. (U.S. Patent Application No. 7,234,136) (hereinafter, "Tirumalai"), in view of Raina (U.S. Patent Application No. 6,134,675), in further view of Quach (U.S. Patent Application No. 6,640,313). Applicants respectfully note that since Claim 2 is cancelled herein without prejudice, the 35 U.S.C. §103(a) rejection of Claim 2 is moot. The rejections and comments set forth in the instant Office Action have been carefully considered by the Applicants. Applicants respectfully submit that Claims 1, 3, 5-10, 14-15, and 18 are patentable over Metzger, in view of Tirumalai, in view of Raina, and in further view of Quach, for at least the following rationale.

Applicants respectfully submit that the combination of Metzger, Tirumalai, Raina, and Quach fails to suggest the features of Claims 1, 3, 5-10, 14-15, and 18 because the combination of Metzger, Tirumalai, Raina, and Quach does not satisfy the requirements of a *prima facie* case of obviousness.

Applicants respectfully point out that Claim 1 (Claims 5 and 18 include similar features) recites:

> A method of compiling a program to be executed on a target microprocessor with multiple functional units of a same type, the method comprising opportunistically scheduling a redundant operation on one of the functional units that would otherwise be idle during a cycle.

(Emphasis added.)

Applicants respectfully note that "[a]s reiterated by the Supreme Court in *KSR*, the framework for the objective analysis for determining obviousness under 35 U.S.C. 103 is stated in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966). Obviousness is a question of law based on underlying factual inquiries" including "[a]scertaining the differences between the claimed invention and the prior art" (MPEP 2141(II)). "In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious" (emphasis in original; MPEP 2141.02(I)). Applicants note that "[t]he prior art reference (or references when combined) need not teach or suggest all the claim limitations. However, Office personnel must explain why the difference(s) between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art" (emphasis added; MPEP 2141[III]).

Additionally, MPEP §2141.02 VI provides, "[a] prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention" (emphasis added; MPEP 2141.02 VI, *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 [Fed. Cir. 1983], *cert. denied*, 469 U.S. 851 [1984]).

Additionally, Applicants respectfully submit that "[i]f the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed amendment" (emphasis added) (MPEP 2143.01; *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)). Moreover, Applicants

respectfully submit that the instant Office Action fails to explain why these differences would have been obvious to one of ordinary skill in the art.

Applicants respectfully submit that the features of Applicants' Claim 1 as a whole would not have been obvious over Metzger, in view of Tirumalai, in view of Raina, and in further view of Quach, and therefore the instant Office Action does not satisfy the requirements for a rejection of Claims 1 under U.S.C. §103(a). In particular, Applicants respectfully submit that the instant Office Action fails to explain the differences between Metzger, Tirumalai, Raina, Quach, and Applicants' claimed features, in which portions of Tirumalai teach away from Applicants' claimed features.

Applicants respectfully agree with the instant Office Action that states, "[h]owever, Metzger does not disclose opportunistically scheduling a redundant operation functional units" (instant Office Action, page 3, section 2). The instant Office Action further states that "Tirumalai discloses opportunistically scheduling a redundant operation with functional units" (instant Office Action, pages 3-4, section 2).

However, Applicants respectfully submit that the teachings of Tirumalai lead away from Applicants' Claim 1. In particular, Applicants understand Tirumalai to teach "a system for generating code to perform anticipatory prefetching for data references" (Tirumalai, column 3, lines 44-46). Further, Tirumalai recites:

> In this embodiment, the system inserts prefetch instructions into the code so that multiple prefetch instructions are issued for the same prefetch address (step 702). This

> ensures that the prefetch operation takes place even if some of the issued prefetch instructions are dropped by the underlying hardware. Prefetch operations are speculative and, hence, may not be doing useful work. Consequently, in situations where the system has to wait for a prefetch instruction, it is typically preferable to drop the prefetch instruction rather than to wait for the prefetch instruction.
>
> Note that in multiple-issue processor architectures, there are often many unused instruction slots that can be filled with redundant prefetch operations without adversely affecting system performance.
>
> Also note that as processor speeds continue to increase faster than memory access times, the cost of a cache miss is becoming increasingly severe. Hence, it is beneficial to issue redundant prefetch operations to potentially avoid a cache miss.

(Emphasis added; Tirumalai, columns 8-9, lines 63-18.) Furthermore, Tirumalai provides:

> In this way, a prefetch for a given access to array A is issued three times in successive loop iterations. Note that the time separation between prefetches for a given data reference makes it unlikely that a single event will cause all of the prefetches for the given data reference to be dropped by the computer system.

(Emphasis added; Tirumalai, column 9, lines 30-35.) Applicants understand Tirumalai to provide multiple redundant prefetched instructions so that the effect of an expected drop (cache miss) of one or more of these prefetched redundant instructions issued at separate times does not severely impact the processor's operation. In contrast, features of Applicants' Claim 1 schedules a redundant operation on only "one" of the functional units, and do not account for cache misses. Additionally, Applicants understand Tirumalai to operate over a span of successive cycles ("successive loop iterations"), whereas Applicants' Claim 1 occurs during "a cycle" (emphasis added).

Applicants respectfully submit that Tirumalai's prefetching of instructions occurring over several cycles teaches away from portions of Applicants' "method of … scheduling a redundant

operation on one of the functional units that would otherwise be idle during a cycle …" as recited in Applicants' Claim 1.

Additionally, Applicants respectfully submit that the proposed modification of Metzger via Tirumalai would render Metzger unsatisfactory for its intended purpose. Furthermore, the proposed modification of Tirumalai via Metzger would render Tirumalai unsatisfactory for its intended purpose. Therefore, there is no suggestion or motivation to make this proposed modification. Applicants understand Metzger to teach a "method and apparatus for compiling code" (Metzger, Title) in which "[t]he selector 303, register allocator 305, and scheduler 307 may take unscheduled instructions and schedule those instructions" (Metzger, column 2, lines 57-59).

> However, conflicts may occur due to registers being already allocated when a new instruction is selected that may require a register. In addition, another conflict that may occur is when the scheduler 307 attempts to schedule an instruction when a particular functional unit in the target architecture is already committed.

(Metzger, columns 2-3, lines 66-4.) Additionally, "[c]onflict interface 309 may provide a means for resolving conflicts from the register allocator 305 or scheduler 307" (Metzger, column 3, lines 15-16). In other words, Applicants understand Metzger to focus on the allocation of unscheduled instructions to functional units, and then providing a means of resolving conflicts when more than one instruction is scheduled to be allocated to the same functional unit.

Applicants respectfully submit that Tirumalai's method of generating multiple redundant prefetches to multiple functional units conflicts with Metzger's intended purpose of allocating unscheduled instructions to these multiple functional units, and therefore would render Metzger's unsatisfactory for its intended purpose. Furthermore, Metzger's method of allocating unscheduled instructions to multiple functional units conflicts with Tirumalai's intended purpose of filling "instruction slots … with redundant prefetch operations" (Tirumalai, column 9, lines 10-12), and therefore would render Tirumalai unsatisfactory for its intended purpose. Metzger and Tirumalai have such different structures and different intended functions that the modification of each by the other would render both Metzger and Tirumalai unsatisfactory for each's intended purpose.

Furthermore, Applicants respectfully agree with the instant Office Action that states, "Metzger also does not disclose multiple functional units of a same type" (instant Office Action, page 4, section 2). However, the instant Office Action further states, "… Raina discloses multiple functional units of the same type" (instant Office Action, page 4, section 2). Applicants respectfully note that the Claim 1 features of "opportunistically scheduling a redundant operation on one of the functional units that would otherwise be idle during a cycle" is performed by a program compiler.

In contrast, the instant Office Action cites to Raina in relation to this claimed feature. Applicants respectfully submit that Raina pertains to testing a multi-core processor (Raina, Field of the Invention), not a technique for compiling a software program. Furthermore, Applicants

respectfully submit that there is no motivation within Raina to modify Metzger and Tirumalai to arrive at the features of Applicants' Claim 1.

Furthermore, the instant Office Action states that, "Quach disclose[s] scheduling a comparison … of results from the redundant operation" (instant Office Action, page 5, section 2). Applicants respectfully submit that the teachings of Quach teach away from Applicants' Claim 1. In particular, Applicants understand Quach to teach "a processor capable of operating in high reliability and high performance modes in response to mode switch events" (Quach, Abstract).

> For one embodiment of the invention, the processor includes a check unit that is activated in HR mode and deactivated in HP mode. The check unit compares the execution results generated by the first and second execution clusters when it is activated, and signals an error when the execution results do not match.

(Emphasis added; Quach, column 2, lines 42-47.) Applicants understand Quach's check unit to be deactivated in high performance (HP) mode, and thus not comparing execution results. In contrast, features of Applicants' Claim 1 include "opportunistically scheduling a redundant operation on one of the functional units that would otherwise be idle during a cycle and scheduling a comparison of results from the redundant operation".

Applicants respectfully submit that Quach's microprocessor with high-reliability operating mode designed to have a deactivated check unit during high performance mode teaches away from portions of Applicants' Claim 1 that include comparing results, regardless of performance level. Furthermore, Applicants respectfully submit that there is no motivation

within Quach to modify Metzger, Tirumalai, and Raina to arrive at the features of Applicants' Claim 1.

Applicants respectfully submit that the combination of Metzger, Tirumalai, and Quach as a whole fails to suggest the features of Applicants' Claim 1 because Tirumalai and Quach teach away from Applicants' Claim 1, the combination of Metzger and Tirumalai would render both Metzger and Tirumalai unsatisfactory for their intended purposes, and Raina should not be applied as described herein. Furthermore, Applicants respectfully submit that the instant Office Action fails to explain the differences between Applicants' Claim 1, Metzger, Tirumlai, Raina, and Quach.

Thus, in view of the combination of Metzger, Tirumalai, Raina, and Quach not satisfying the requirements of a *prima facie* case of obviousness, Applicants respectfully assert that Claim 1 is patentable. Moreover, Applicants respectfully submit that Claims 5 and 18, including features similar to Claim 1, are patentable for the reasons given herein in regards to the patentability of Claim 1. Furthermore, Applicants respectfully submit that Claim 3 depending on Claim 1, and Claims 6-15 depending on Claim 5 are patentable as being dependent upon an allowable base Claim.

B. Claim 4

The instant Office Action rejects Claim 4 under 35 U.S.C. §103(a) as being unpatentable over Metzger, in view of Tirumalai, in view of Raina, in further view of Quach, in further view of Fruehling et al. (U.S. Patent Application No. 6,625,688) (hereinafter, "Fruehling"). The

rejections and comments set forth in the instant Office Action have been carefully considered by the Applicants. Applicants respectfully submit that Claim 4 is patentable over Metzger, in view of Tirumalai, in view of Raina, in further view of Quach, and in further view of Fruehling for at least the following rationale.

Applicants respectfully submit that the combination of Metzger, Tirumalai, Raina, Quach, and Fruehling does not satisfy the requirements of a *prima facie* case of obviousness because features of Applicants' Claim 1 as a whole are not obvious via the combination of Metzger, Tirumalai, Raina, Quach, and Fruehling.

As presented above, Applicants respectfully submit that Tirumalai and Quach teach away from Applicants' Claim 1. Further, Applicants respectfully submit that the modification of Metzger via Tirumalai and the modification of Tirumalai via Metzger would make both Metzger and Tirumalai unsatisfactory for each's intended purposes. Moreover, Applicants respectfully submit that Raina should not be applied to Applicants' Claim 1 as described herein in section A. Furthermore, Applicants respectfully submit that the combination of Metzger, Tirumalai, Raina, Quach, and Fruehling fails to suggest the features of Applicants' Claim 1 as a whole because Fruehling does not overcome the shortcomings of Metzger, Tirumalai, Raina, and Quach.

The instant Office Action states on page 13, section 3, that "Fruehling discloses setting a user selectable level for an aggressiveness of said opportunitisic [sic] scheduling". Applicants understand Fruehling to teach a "method and circuit for analysis of the operation of a

microcontroller using signature analysis of memory" (Fruehling, Title). Specifically, Fruehling does not suggest the features of Applicants' Claim 1.

Additionally, Applicants respectfully submit that the instant Office Action does not explain why the differences described herein between Metzger, Tirumalai, Raina, Quach, Fruehling, and the features of Applicants' Claim 1 would have been obvious to one or ordinary skill in the art.

Thus, in view of the combination of Metzger, Tirumalai, Raina, Quach, and Fruehling not satisfying the requirements of a *prima facie* case of obviousness, Applicants respectfully assert that Claim 1 is patentable over Metzger, in view of Tirumalai, in view of Raina, in view of Quach, and further in view of Fruehling. Furthermore, Applicants respectfully submit that Claim 4 depending on Claim 1 is patentable as being dependent upon an allowable base Claim.

C. Claims 11, 13, and 16-17

The instant Office Action rejects Claims 11, 13, and 16-17 under 35 U.S.C. §103(a) as being unpatentable over Metzger, in view of Tirumalai, in view of Raina, in further view of Quach, in further view of Chan et al. (U.S. Patent Application No. 5,557,761) (hereinafter, "Chan"). The rejections and comments set forth in the instant Office Action have been carefully considered by the Applicants. Applicants respectfully note that Claim 17 is cancelled herein without prejudice. Therefore, Applicants respectfully submit that the 35 U.S.C. §103(a) rejection of Claim 17 is moot. Additionally, Applicants respectfully submit that Claims 11, 13,

and 16 are patentable over Metzger, in view of Tirumalai, in view of Raina, in further view of Quach, and in further view of Chan for at least the following rationale.

Applicants respectfully submit that the combination of Metzger, Tirumalai, Raina, Quach, and Chan does not satisfy the requirements of a *prima facie* case of obviousness because features of Applicants' Claim 1 as a whole are not obvious via the combination of Metzger, Tirumalai, Raina, Quach, and Chan.

As presented above, Applicants respectfully submit that Tirumalai and Quach teach away from Applicants' Claim 1. Further, Applicants respectfully submit that the modification of Metzger via Tirumalai and the modification of Tirumalai via Metzger would make both Metzger and Tirumalai unsatisfactory for each's intended purposes. Moreover, Applicants respectfully submit that Raina should not be applied to Applicants' Claim 1 as described herein in section A. Furthermore, Applicants respectfully submit that the combination of Metzger, Tirumalai, Raina, Quach, and Chan fails to suggest the features of Applicants' Claim 1 as a whole because Chan does not overcome the shortcomings of Metzger, Tirumalai, Raina, and Quach.

Applicants understands Chan to teach a "method of generating object code using aggregate instruction movement" (Chan, Title). Specifically, Chan does not suggest the features of Applicants' Claim 1.

Additionally, Applicants respectfully submit that the instant Office Action does not explain why the differences described herein between Metzger, Tirumalai, Raina, Quach, Chan, and Applicants' features of Claim 1 would have been obvious to one or ordinary skill in the art.

Thus, in view of the combination of Metzger, Tirumalai, Raina, Quach, and Chan not satisfying the requirements of a *prima facie* case of obviousness, Applicants respectfully assert that Claim 1 is patentable over Metzger, in view of Tirumalai, in view of Raina, in view of Quach, and further in view of Chan. Moreover, Applicants respectfully submit that Claims 5 and 16 are patentable for reasons given herein with regards to the patentability of Claim 1. Furthermore, Applicants respectfully submit that Claims 11 and 13 depending on Claim 5 are patentable as being dependent upon an allowable base Claim.

D. Claim 12

The instant Office Action rejects Claim 12 under 35 U.S.C. §103(a) as being unpatentable over Metzger, in view of Tirumalai, in view of Raina, in further view of Quach, in view of Chan, and in further view of Fruehling. The rejections and comments set forth in the instant Office Action have been carefully considered by the Applicants. Applicants respectfully submit that Claim 12 is patentable over Metzger, in view of Tirumalai, in view of Raina, in further view of Quach, in view of Chan, and in further view of Fruehling for at least the following rationale.

Applicants respectfully submit that the combination of Metzger, Tirumalai, Raina, Quach, Chan, and Fruehling does not satisfy the requirements of a *prima facie* case of

obviousness because features of Applicants' Claim 1 as a whole are not obvious via the combination of Metzger, Tirumalai, Raina, Quach, Chan, and Fruehling.

As presented above, Applicants respectfully submit that Tirumalai and Quach teach away from Applicants' Claim 1. Further, Applicants respectfully submit that the modification of Metzger via Tirumalai and the modification of Tirumalai via Metzger would make both Metzger and Tirumalai unsatisfactory for each's intended purposes. Moreover, Applicants respectfully submit that Raina should not be applied to Applicants' Claim 1 as described herein in section A.

Furthermore, Applicants respectfully submit that the combination of Metzger, Tirumalai, Raina, Quach, Chan, and Fruehling fails to suggest the features of Applicants' Claim 1 as a whole because neither Chan nor Fruehling overcome the shortcomings of Metzger, Tirumalai, Raina, and Quach. Additionally, Applicants respectfully submit that the instant Office Action does not explain why the differences described herein between Metzger, Tirumalai, Raina, Quach, Chan, Fruehling, and Applicants' features of Claim 1 would have been obvious to one or ordinary skill in the art.

Thus, in view of the combination of Metzger, Tirumalai, Raina, Quach, Chan, and Fruehling not satisfying the requirements of a *prima facie* case of obviousness, Applicants respectfully assert that Claim 1 is patentable over Metzger, in view of Tirumalai, in view of Raina, in further view of Quach, in view of Chan, and in further view of Fruehling. Moreover, Applicants respectfully submit that Claim 5 is patentable for reasons given herein with regards to

the patentability of Claim 1. Furthermore, Applicants respectfully submit that Claim 12 depending on Claim 5 is patentable as being dependent upon an allowable base Claim.

CONCLUSION

In light of the above-listed remarks, the Applicants respectfully request allowance of Claims 1, 3-16, and 18.

The Examiner is urged to contact Applicants' undersigned representative if the Examiner believes such action would expedite resolution of the present Application.

Respectfully submitted,

WAGNER BLECHER LLP

Date: 03/17/2009

/John P. Wagner, Jr./

John P. Wagner, Jr.
Registration No. 35,398

Wagner Blecher LLP

123 Westridge Drive
Watsonville, CA 95076
(408) 377-0500